Electronic Instruments for the Life Sciences

made to measure

OPERATING INSTRUCTIONS AND SYSTEM DESCRIPTION FOR THE

INR-01-T

SIGNAL ENVELOPE / INTEGRATOR MODULE FOR EPMS SYSTEMS

VERSION 1.2
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1. Safety Regulations

<u>VERY IMPORTANT</u>: Instruments and components supplied by npi electronic are NOT intended for clinical use or medical purposes (e.g. for diagnosis or treatment of humans), or for any other life-supporting system. npi electronic disclaims any warranties for such purpose. Equipment supplied by npi electronic must be operated only by selected, trained and adequately instructed personnel. For details please consult the GENERAL TERMS OF DELIVERY AND CONDITIONS OF BUSINESS of npi electronic, D-71732 Tamm, Germany.

1) GENERAL: This system is designed for use in scientific laboratories and must be operated only by trained staff. General safety regulations for operating electrical devices should be followed.
2) AC MAINS CONNECTION: While working with the npi systems, always adhere to the appropriate safety measures for handling electronic devices. Before using any device please read manuals and instructions carefully.
   The device is to be operated only at 115/230 Volt 60/50 Hz AC. Please check for appropriate line voltage before connecting any system to mains.
   Always use a three-wire line cord and a mains power-plug with a protection contact connected to ground (protective earth).
   Before opening the cabinet, unplug the instrument.
   Unplug the instrument when replacing the fuse or changing line voltage. Replace fuse only with an appropriate specified type.
3) STATIC ELECTRICITY: Electronic equipment is sensitive to static discharges. Some devices such as sensor inputs are equipped with very sensitive FET amplifiers, which can be damaged by electrostatic charge and must therefore be handled with care. Electrostatic discharge can be avoided by touching a grounded metal surface when changing or adjusting sensors. **Always turn power off when adding or removing modules, connecting or disconnecting sensors, headstages or other components from the instrument or 19” cabinet.**
4) TEMPERATURE DRIFT / WARM-UP TIME: All analog electronic systems are sensitive to temperature changes. Therefore, all electronic instruments containing analog circuits should be used only in a warmed-up condition (i.e. after internal temperature has reached steady-state values). In most cases a warm-up period of 20-30 minutes is sufficient.
5) HANDLING: Please protect the device from moisture, heat, radiation and corrosive chemicals.

2. EPMS-07 Modular Plug-In System

2.1. General System Description / Operation

The npi EPMS-07 is a modular system for processing of bioelectrical signals in electrophysiology. The system is housed in a 19” rack-mount cabinet (3U) has room for up to 7 plug-in units. The plug-in units are connected to power by a bus at the rear panel.

The plug-in units must be kept in position by four screws (M 2,5 x 10). The screws are important not only for mechanical stability but also for proper electrical connection to the system housing. Free area must be protected with covers.

2.2. EPMS-07 Housing

The following items are shipped with the EPMS-07 housing:

- ✓ EPMS-07 cabinet with built-in power supply
- ✓ Mains cord
- ✓ Fuse 2 A / 1 A, slow (inserted)
- ✓ Front covers

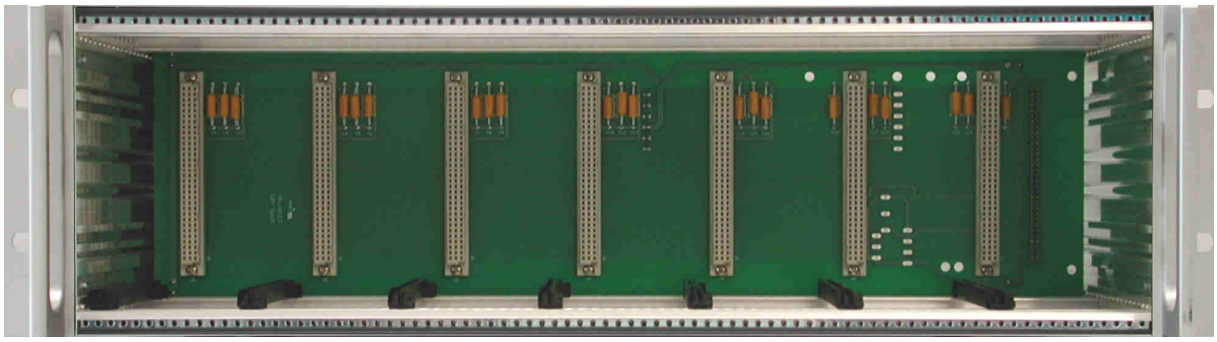

Figure 1: Left: front view of empty EPMS-07 housing.

In order to avoid induction of electromagnetic noise the power supply unit, the power switch and the fuse are located at the rear of the housing (see Figure 2, right).

2.3. EPMS-H-07 Housing

In addition to the standard power supply of the EPMS-07, the EPMS-H-07 has a built-in high voltage power supply. This is necessary for all MVCS / MVCC modules, the HVA-100, HV-TR150 and HVC-03M modules. The output voltage depends on the modules in use.

2.4. EPMS-E-07 Housing

The following items are shipped with the EPMS-E-07 housing:

- ✓ EPMS-E-07 cabinet
- ✓ External Power supply PWR-03D
- ✓ Power cord (PWR-03D to EPMS-E-07)
- ✓ Mains chord
- ✓ Fuse 1.6 A / 0.8 A, slow (inserted)
- ✓ Front covers

The EPMS-E-07 housing is designed for low-noise operation, especially for extracellular and multi-channel amplifiers with plugged in filters. It operates with an external power supply to minimize distortions of the signals caused by the power supply.

2.5. EPMS-03

The following items are shipped with the EPMS-03 housing:

- ✓ EPMS-03 cabinet with built-in power supply
- ✓ Mains cord
- ✓ Fuse 034 A / 0,2 A, slow (inserted)
- ✓ Front covers

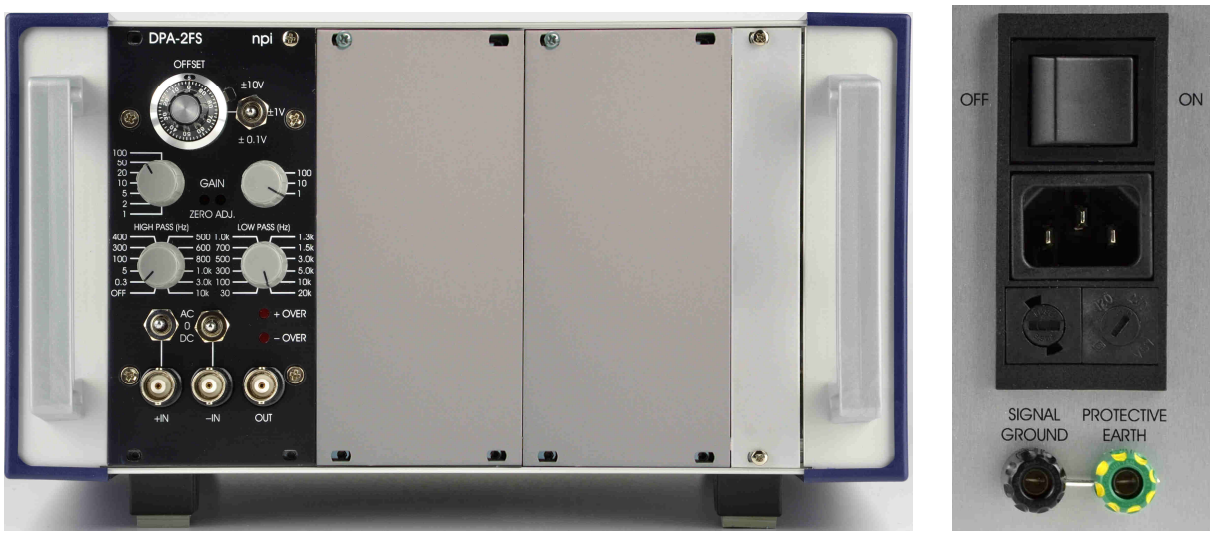

Figure 2: Left: front view of EPMS-03 housing. Right: rear panel detail of EPMS-03 and EPMS-07 housing.

In order to avoid induction of electromagnetic noise the power supply unit, the power switch and the fuse are located at the rear of the housing (see Figure 2, right).

2.6. PWR-03D

The external power supply PWR-03D is capable of driving up to 3 EPMS-E housings. Each housing is connected by a 6-pole cable from one of three connectors on the front panel of the PWR-03D to the rear panel of the respective EPMS-E housing. (see Figure 3,

Figure 4). A POWER LED indicates that the PWR-03D is powered on (see Figure 3, left). Power switch, voltage selector and fuse are located at the rear panel (see Figure 3, right).

Note: The chassis of the PWR-03D is connected to protective earth, and it provides protective earth to the EPMS-E housing if connected.

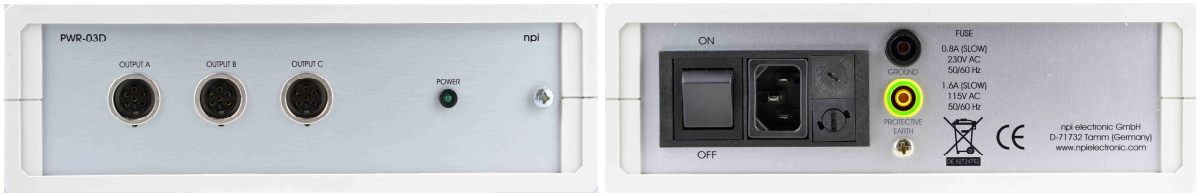

Figure 3: Left: PWR-03D front panel view Right: PWR-03D rear panel view.

Note: This power supply is intended to be used with npi EPMS-E systems only.

2.7. System Grounding

EPMS-07/EPMS-03

The 19" cabinet is grounded by the power cable through the ground pin of the mains connector (= protective earth). In order to avoid ground loops the internal ground is isolated from the protective earth. The internal ground is used on the BNC connectors or GROUND plugs of the modules that are inserted into the EPMS-07 housing. The internal ground and mains ground (= protective earth) can be connected by a wire using the ground plugs on the rear panel of the instrument. It is not possible to predict whether measurements will be less or more noisy with the internal ground and mains ground connected. We recommend that you try both arrangements to determine the best configuration.

EPMS-E-07

The 19" cabinet is connected to the CHASSIS connector at the rear panel. It can be connected to the SYSTEM GROUND (SIGNAL GROUND) on the rear panel of the instrument (see

Figure 4).
The chassis can be linked to PROTECTIVE EARTH by connecting it to the PWR-03D with the supplied 6-pole cable **and** by interconnecting the GROUND and PROTECTIVE EARTH connectors on the rear panel of the PWR-03D (see Figure 3). Best performance is generally achieved without connection of the chassis to protective earth.

Important: Always adhere to the appropriate safety measures.

Figure 4: Rear panel connectors of the EPMS-E-07

2.8. Technical Data

EPMS-07, EPMS-E-07 and EPMS-H-07

19” rackmount cabinet, for up to 7 plug-in units
Dimensions: 3U high (1U=1 3/4” = 44.45 mm), 254 mm deep

EPMS-07 and EPMS-H-07

Power supply: 115/230 V AC, 60/50 Hz, fuse 2 A / 1 A slow, 45-60 W

EPMS-E-07

External power supply (PWR-03D) 115/230 V AC, 60/50 Hz, fuse 1.6/0.8 A, slow
Dimensions of external power supply: (W x D x H) 225 mm x 210 mm x 85 mm

EPMS-03

Power supply: 115/230 Volts AC, 60/50 Hz, fuse 0.4 A / 0.2 A slow
Maximum current supply: 500 mA

Dimensions: 3U high (1U=1 3/4” = 44.45 mm), 254 mm deep, 265 mm wide

3. INR-01-T Signal Envelope / Integrator Module

3.1. INR-01-T Components

The following items are shipped with the INR-01-T:

✓ Integrator module for the EPMS-07 system
✓ User manual

3.2. INR-01-T System Description

The INR-01-T module is designed for generating envelopes from noisy INPUT signals, e.g. to facilitate detection of oscillations from extracellular measurements in excitable tissues. The INPUT signal is rectified by an “absolute value” circuit and subsequently applied to a “leaky integrator” for filtering. The time constant of integration can be set using a 6-position switch. Additionally, a THRESHOLD can be set in order to mask the noise around the baseline that contains no information of interest, and the OUTPUT envelope can be corrected for OFFSETs before amplification.

3.4. Description of the Front Panel and Operation

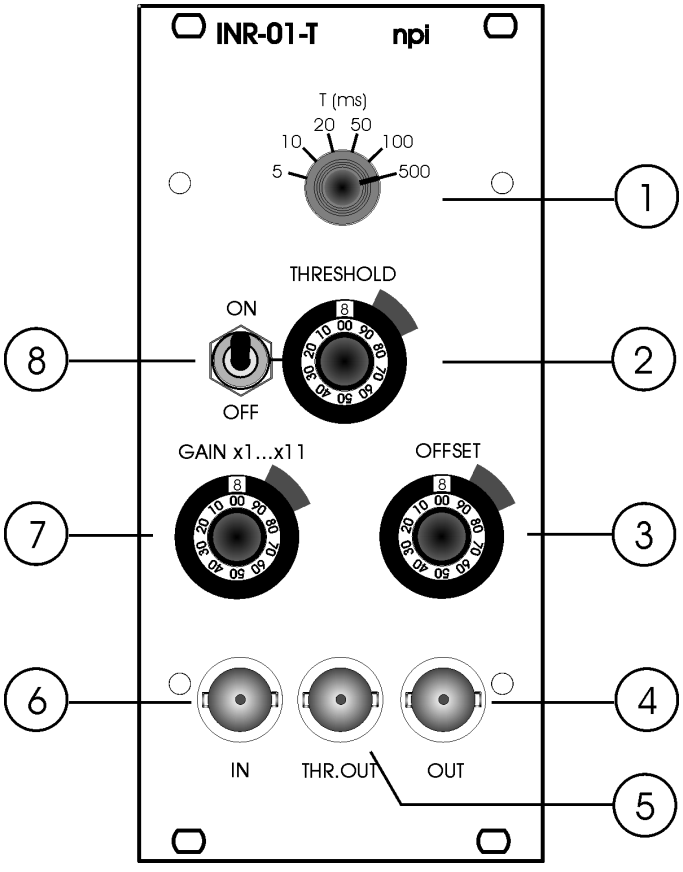

Figure 5: INR-01-T front panel view

In the following description of the front panel elements each element has a number that is related to that in Figure 5. The number is followed by the name (in uppercase letters) written on the front panel and the type of the element (in lowercase letters). Then, a short description of the element is given.

(**1**) T(ms) switch

6-position switch for setting the time constant of the “leaky integrator”

(**2**) THRESHOLD potentiometer

10-turn potentiometer for setting the threshold of the signal to be processed. Used to blank a noisy baseline that contains no signal of interest. Range: ±1 V

(**3**) OFFSET potentiometer

10-turn potentiometer for canceling the offset of the OUTPUT. Range: 0…1 V

(**4**) OUT connector

BNC connector providing the processed signal

(**5**) THR.OUT connector

BNC connector providing the signal processed by the THRESHOLD electronics. This signal will be rectified and integrated if the THRESHOLD mode is selected (see #**8**)

Note: The output is always active, regardless of the position of the THRESHOLD ON / OFF switch.

(**6**) IN connector

BNC connector for the input of the signal to be processed

(**7**) GAIN potentiometer

10-turn potentiometer for continuous setting the amplification factor of the integrated signal. Range: x1…x11

(**8**) THRESHOLD ON / OFF switch

Switch to enable (THRESHOLD) or disable (OFF) the threshold function

Note: The THR.OUT output is always active, regardless of the position of the THRESHOLD ON / OFF switch.

4. Examples

All traces were recorded with an integrator time constant of 5 ms and a gain of 2.

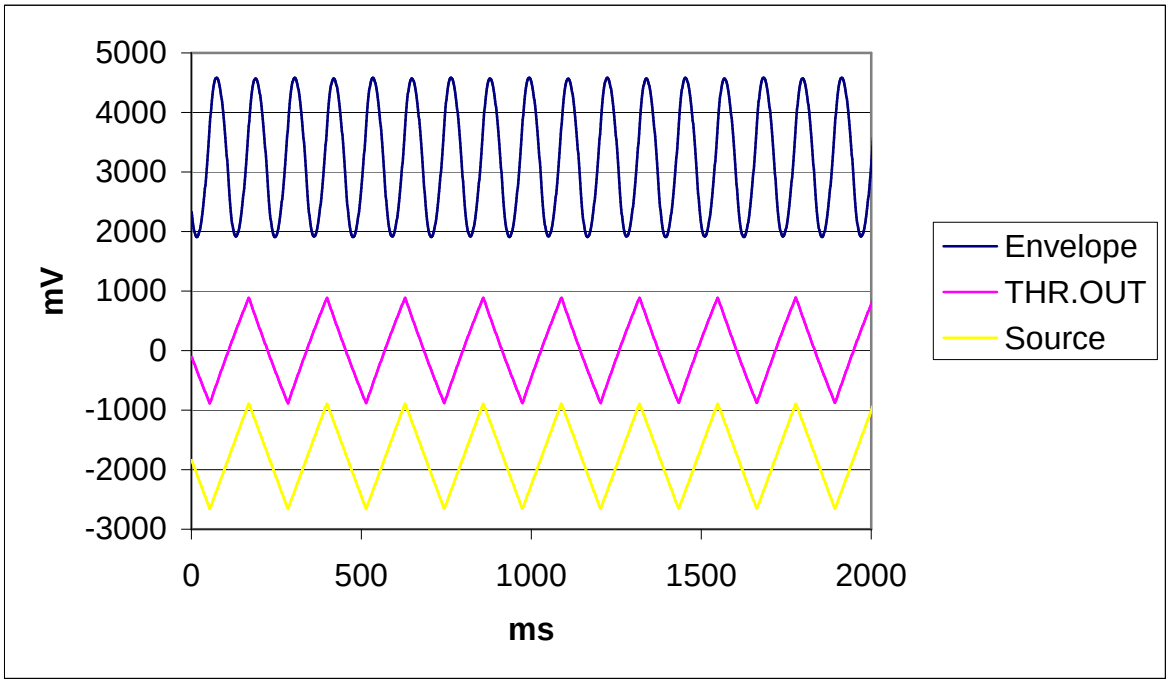

Figure 6: Example using a triangle voltage as signal source, **no THRESHOLD** set.

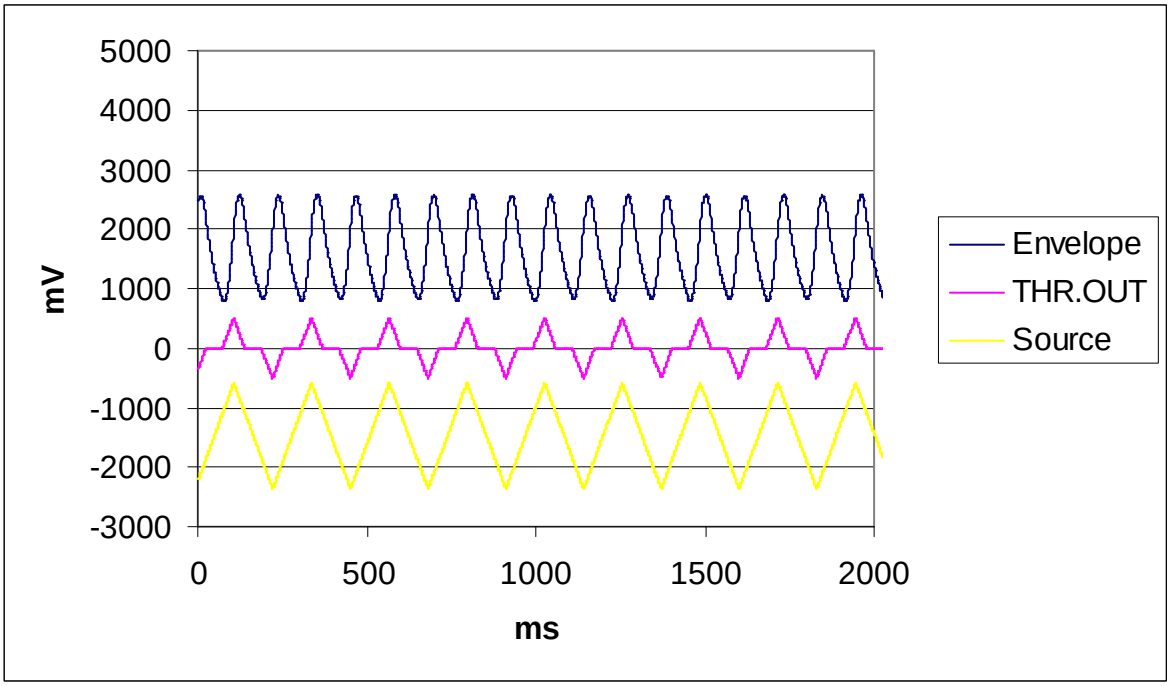

Figure 7: Example using a triangle voltage as source, **with THRESHOLD** set.

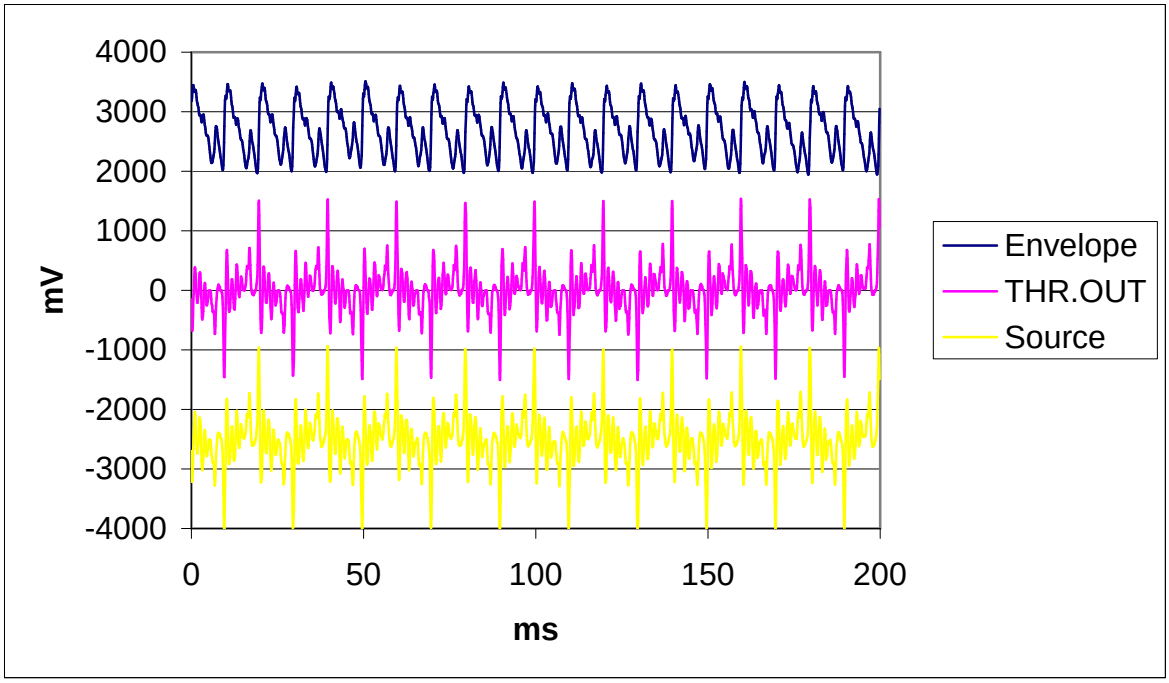

Figure 8: Example using 50 Hz noise as source, **no THRESHOLD**.

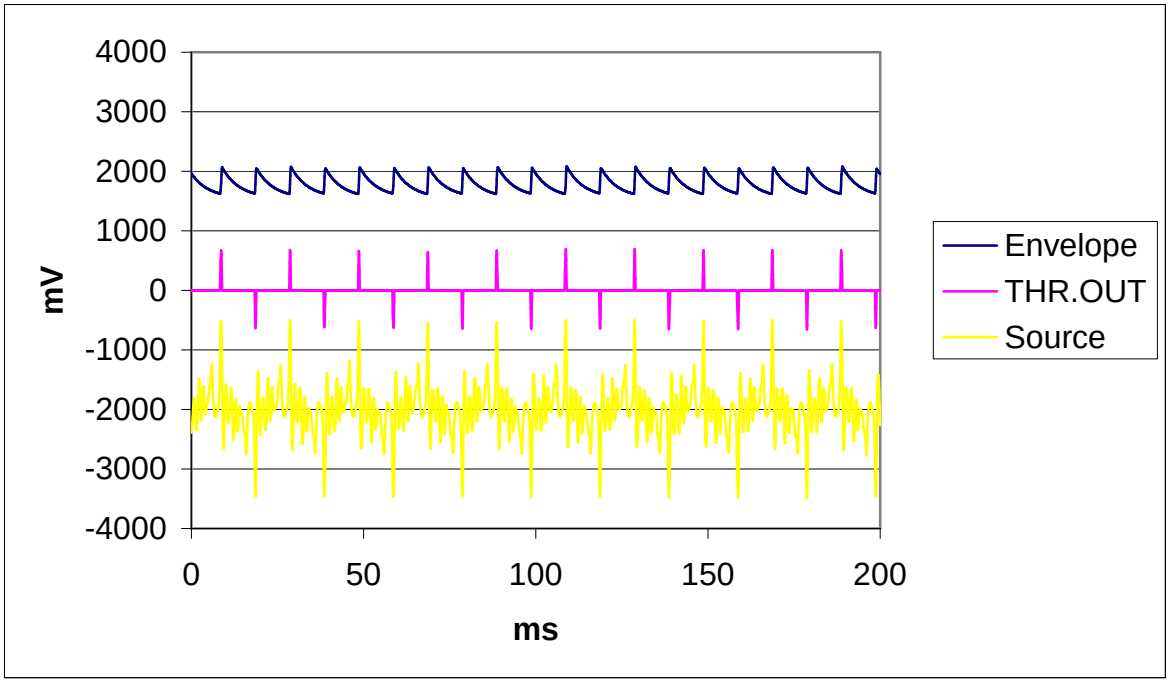

Figure 9: Example using 50 Hz noise as source, **with THRESHOLD** set.

5. Technical Data

Input impedance:	1 MΩ / 20 pF
Output impedance:	249 Ω
INPUT voltage range :	±1 V
GAIN factor:	x1…x11, continuous adjustment
Output voltage range:	± 11 V max.
Integration time constants:	5, 10, 20, 50, 100, 500 ms, selectable by rotary switch
OFFSET range:	0…1 V
THRESHOLD range:	±1 V